(21) Application No 9223852.6

(22) Date of filing 13.11.1992

(30) Priority data
(31) 9120768 (32) 21.11.1991 (33) KR

(71) Applicant
Samsung Electronics Co. Ltd.

(Incorporated in the Republic of Korea)

No 416 Maetan-dong, Kwonsun-ku, Suweon, Kyungki-do, Republic of Korea

(72) Inventor
Joo Han Nam

(74) Agent and/or Address for Service
Venner Shipley & Co
368 City Road, London, EC1V 2QA, United Kingdom

(51) INT CL⁵
B41J 32/00, B65H 75/18 // B41J 17/36

(52) UK CL (Edition L)
B8M MCC MC101 MC103 MC105
B6F FPX

(56) Documents cited
GB 2024490 A	EP 0351515 A	US 5018040 A
US 4972288 A	US 4970531 A	US 4969761 A
US 4623902 A		

(58) Field of search
UK CL (Edition K) B6F FPX, B8M MCC, G5R RJB
INT CL⁵ B41J, G11B

(54) **Spooled tape length indicating device**

(57) A photo-detector 7 detects the passing of reflective regions of a reflector 4 rotating with a first reel 2. The rotational period of the first reel is determined from the output of the photo-sensor by a processing circuit 8. Accepting that a tape 1 travels at constant linear velocity between a second reel 3 and the first reel, the processing circuit 8 then outputs a signal indicating the amount of tape remaining on the second reel 3 which is then displayed by the display means 9. Alternatively, the amount of tape wound onto the first reel 2 may be displayed. The device may be used to calculate amounts of ribbon in a cartridge in a colour video printer.
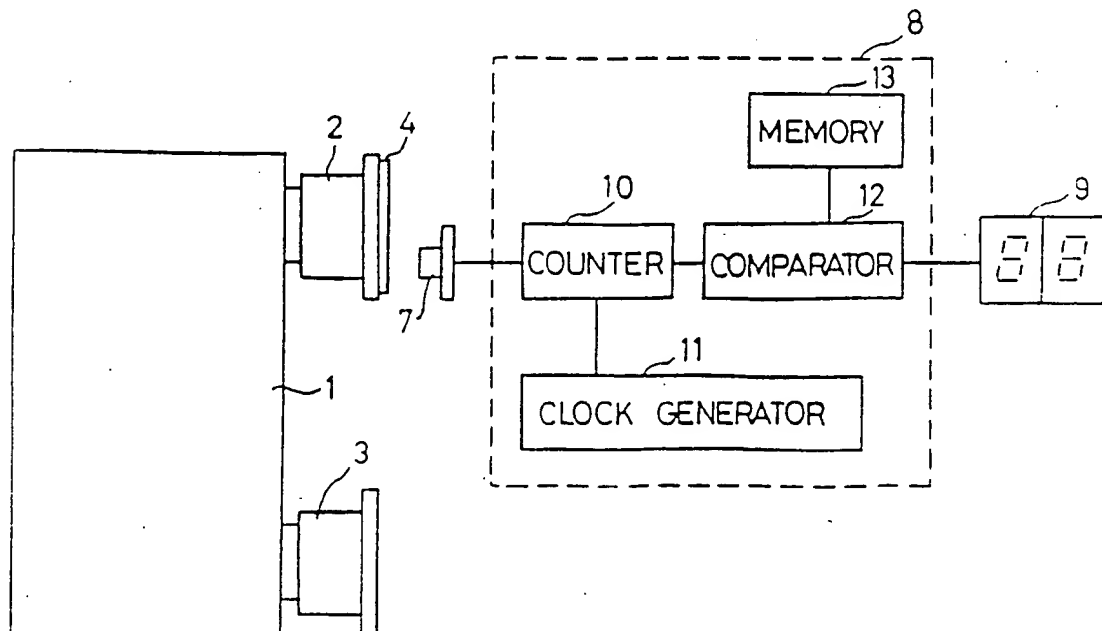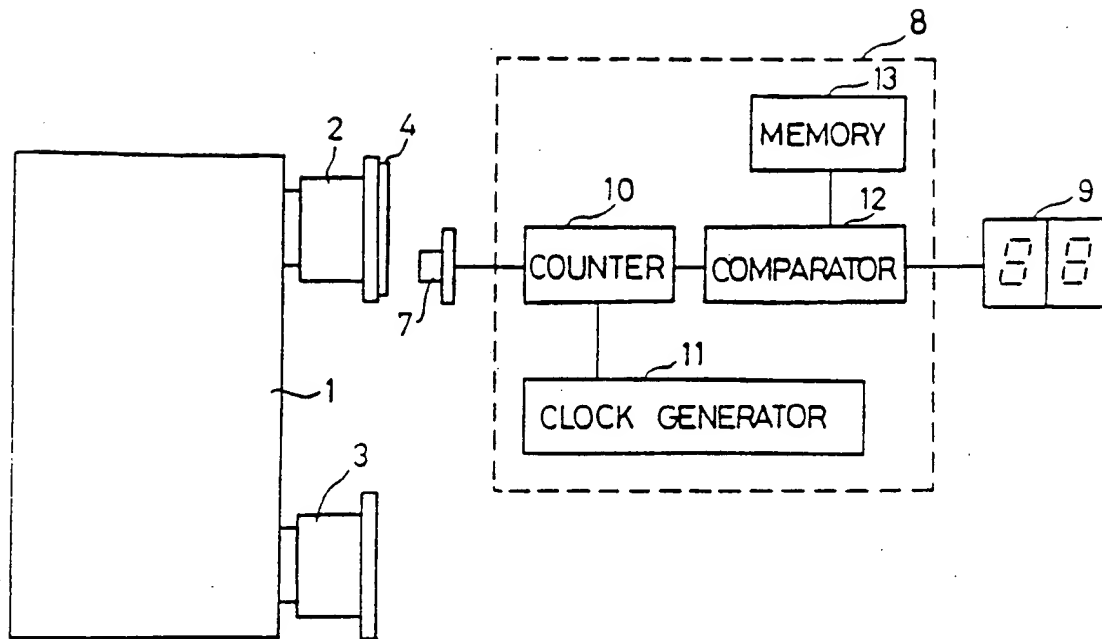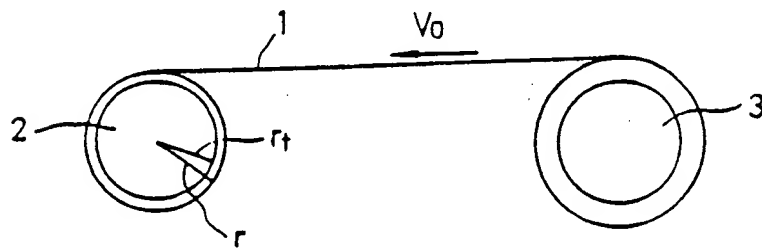
FIG. 1

GB 2 263 467 A

FIG. 1

FIG. 2

FIG. 3

| Y | M | C | Y | C |

Ls   LP   Le

FIG. 4

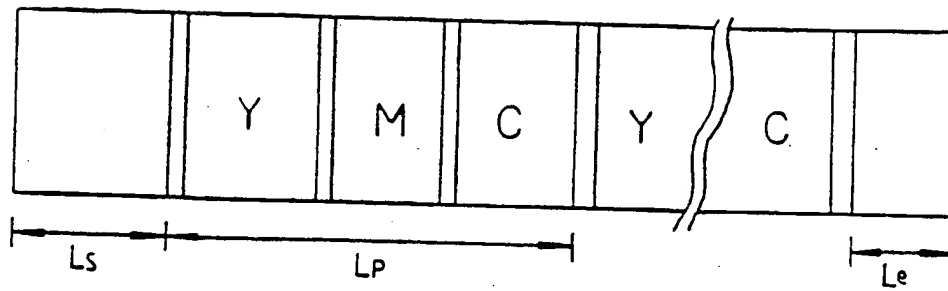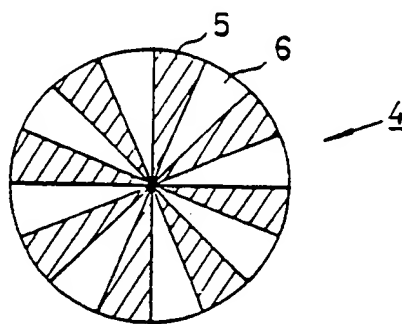5 6

4

- 1 -

SPOOLED TAPE LENGTH INDICATING DEVICE

DESCRIPTION

5

The present invention relates to a spooled tape length
indicating device suitable for a colour video printer
ribbon cartridge.

10

A video picture is printed by a sublimating thermal
transcribing system, wherein the picture is built up
by successively depositing yellow Y, magenta M and cyan
C, as can be seen from Figure 3, in response to a
received video image signal. Generally, a number of
sections, e.g. 50 sections, of ribbon form a tape and
are wound between a supply reel and a take-up reel
within a ribbon cartridge. During printing, the ribbon
wound on the supply reel is unwound and a printing
operation is executed. Then the used ribbon is wound
onto the take-up reel.

However, in a conventional colour video printer, a user cannot know how much tape has been unwound from the supply reel, i.e. the residual amount or consumed amount of the cartridge ribbon, and it has been impossible to know how many pictures may be printed before the ribbon is used up. Accordingly, in case when a spare cartridge has not been previously prepared, exhaustion of the ribbon results in a long delay in the printing process.

An object of the present invention is to provide a spooled tape length indicating device, capable of displaying the residual amount of ribbon for the user's benefit.

According to the present invention, there is provided a spooled tape length indicating device, comprising: detecting means arranged to detect the rotational period of a first tape reel; processing means for producing a length signal representing the length of tape on the first or a second tape reel in response to the output of the detecting means; and display means

for displaying the tape length in response to the length signal.

Preferably, the detecting means is arranged to detect the rotational period of a first tape reel of a video printer system.

Preferably, the processing means comprises a memory storing reference rotational periods, each of which corresponds to a different length of tape on a reel, and comparing means for comparing a present rotational period and a reference rotational period within the memory.

Preferably, the first tape reel is a take-up reel and the second tape reel is a supply reel.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of a device in accordance with the present invention;

Figure 2 is a schematic diagram for illustrating the calculating process according to the present invention;

Figure 3 is a diagram of a cartridge ribbon; and

Figure 4 is a diagram of a reflector for detecting the rotational velocity of a spool according to the present invention.

Referring to Figure 1, a cartridge ribbon 1 which is not yet used is wound on a supply reel 3, and will be unwound as the take-up reel 2 is rotated by a driving motor (not shown) and wound onto the take-up reel 2. A reflector 4, having a surface alternately divided into non-reflecting regions 5 and reflecting regions 6, as shown in Figure 4, is attached to take-up reel 2. A photo-sensor 7 detects light reflected from the reflecting regions 6 of the reflector 4, and a processing circuit 8 processes the signals output by the photo-sensor 7. The processing circuit 8 detects

the rotational velocity of the take-up reel 2 from the reflected light, received by the photo-sensor 7, and compares it with a reference value stored in a memory 13 and calculates the amount of ribbon remaining on the supply spool 3. The calculated amount is displayed by a 7-segment display 9.

Velocity detection of the take-up reel 2 is executed in such a manner that the photo-sensor 7 receives light intermittently reflected by the reflector 4, which is divided into reflecting and non-reflecting regions, each of a predetermined angular width. The photo-sensor 7 converts this into an electrical pulse signal and transmits it to a counter 10, contained within the processing circuit 8. The counter 10 counts the pulse signals from the photo-sensor 7 and simultaneously counts a reference clock from a reference clock generator 11, and latches the clock count at a time when the reel pulse signal reaches a predetermined counting number. This latch value is used to display the rotational period of the take-up reel 2.

The relation between the calculated rotational period T and the amount ribbon remaining on the supply spool 3 is expressed by the equation below. Firstly, a length L of the ribbon wound on the take-up reel 2 is obtained from the following expression:

$$L = \frac{\pi}{t_r} (r^2 - r_t^2)$$

Wherein t_r is a thickness of the ribbon, r is a diameter of the take-up reel wound with the ribbon, and r_t is a diameter of the take-up reel drum. Accordingly, the diameter r of the take-up reel wound with the ribbon becomes:

$$r = \sqrt{\frac{t_r}{\pi} L + r_t^2}$$

The linear velocity V_o of the ribbon 1 during the printing operation is constant, and since the diameter r of the take-up reel 2 is increased in response to the consumption of the ribbon 1, the angular velocity of the take-up reel 2 varies. Therefore, the rotational period T of the take-up reel 2 can be expressed as follows:

$$T = \frac{2\pi}{\omega} = \frac{2\pi r}{V_o}$$

$$\frac{2\pi}{V_o} \sqrt{\frac{t_r}{\pi} L + r_t^2}$$

The ribbon length L wound on the take-up reel 2 includes a consumed amount and an initial margin length l_s and can be expressed as:

$$L = 1_p \cdot n + 1_s$$

Wherein 1_p is a length of the ribbon used for printing of one sheet, which includes regions of the three colours Y, M and C as shown in Figure 3, and n means the number of the current print and 1_s means the initial margin length.

Accordingly, a rotational period T_n of the take-up reel 2 after the printing of n prints is as follows:

$$Tn = \frac{2\pi}{Vo} \sqrt{\frac{t_r \quad (1_p \cdot n + 1_s + r^2)}{\pi}}$$

The relation between the present rotational period Tn of the take-up reel 2 and the number of prints n can be known from this expression. Accordingly, since a predetermined number of sections of the ribbon 1 are wound originally on the supply reel 3 in the cartridge and then delivered, the maximum possible number of

prints N is previously determined, and the rotational period $(T_1, T_2, T_3, \ldots T_n)$ of the take-up reel for the consumed ribbon amount or the residual amount can be derived from the above described expression.

The expected rotational period $(T_1, T_2, T_3, \ldots T_n)$ for each consumed ribbon amount is previously stored in a memory 13. A comparator 12 receives information in regard of the present rotational period T_n of the take-up reel 2, and compares this with the expected rotational period $(T_1, T_2, T_3, \ldots T_n)$ stored in the aforementioned memory 13, and determines the present amount of ribbon consumed. The present rotational period may not be exactly identical with the expected rotational period. Therefore, the nearest, the next lowest or next highest value $(T_1, T_2, T_3, \ldots T_n)$ can be selected as desired in a particular embodiment.

When the residual ribbon length or the consumed ribbon length are determined at the comparator 12, the processing circuit 8 generates an electrical control signal and displays the residual length or the consumed

length on an appropriate display means, e.g. 7-segment display 9. The residual or consumed lengths may be displayed in terms of frames or the like.

5   In the described embodiment, the rotational velocity is detected from the take-up reel 2. However, the same result can be obtained by detecting the rotational velocity of the supply reel 3. The ribbon residual amount or consumed amount may be displayed in either

10   digital or analogue form. Similarly, in order to detect the rotational velocity of the take-up reel 2 or the supply reel 3, known detecting means such as an electromagnetic type or an eddy current type may be used in place of a photo-sensor as described above.

CLAIMS

1.   A spooled tape length indicating device, comprising:
detecting means arranged to detect the rotational period of a first tape reel;
processing means for producing a length signal representing the length of tape on the first or a second tape reel in response to the output of the detecting means; and
display means for displaying a tape length in response to the length signal.

2.   A device according to claim 1, wherein the detecting means is arranged to detect the rotational period of a first tape reel of a video printer system.

3.   A device according to claim 1 or 2, wherein the processing means comprises a memory storing reference rotational periods, each of which corresponds to a different length of tape on a reel, and comparing means

for comparing a present rotational period and a reference rotational period within the memory.

4.   A device according to claim 1, 2 or 3, wherein the first tape reel is a take-up reel and a second tape reel is a supply reel.

5.   A residual amount displaying device of cartridge ribbon for colour video printer in which a ribbon tape successively made of a number of ribbons for printing an inputting video signal is wound between a supply reel and a take-up reel, comprising:

detecting means for detecting a rotational period of any one of the supply reel and the take-up reel;

a memory storing reference rotational periods each of which corresponds to each of ribbon residual numbers;

comparing means for comparing a present reel rotational period and said reference rotational period within the memory and then determining a present ribbon residual amount numbers; and

display means for displaying the ribbon residual amount.

6.   A residual amount displaying device as defined in claim 5, wherein said ribbon residual amount numbers are replaced by ribbon consumed amount numbers.

5   7.   A spooled tape length indicating device substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number
GB 9223852.6

Relevant Technical fields

(i) UK Cl (Edition   )   B6F: FPX, B8M: MCC, G5B: RJB

(ii) Int Cl (Edition   5   )   B41J, G11B

Databases (see over)

(i) UK Patent Office

(ii)   ONLINE DATABASE: WPI

Search Examiner
G WERRETT

Date of Search
10 APRIL 1993

Documents considered relevant following a search in respect of claims   1-7

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2024490 A (SONY) whole document	1,5
X	US 5018040 (Y NISHIDA) whole document	1,5
X	US 4972288 (Y NISHIDA) whole document	1,5
X	US 4970531 (H SHIMIZIU) whole document	1,5
A	US 4969761 (S J GIBSON-SAXTY) whole document	1,5
A	US 4623902 (E YAMANISH) whole document	1,5
A	EP 0351515 A (DATAPRODUCTS CORP) whole document	1,5

Category	Identity of document and relevant passages	Releva to claim(s)

Categories of documents

X: Document indicating lack of novelty or of
inventive step.

Y: Document indicating lack of inventive step if
combined with one or more other documents of the
same category.

A: Document indicating technological background
and/or state of the art.

P: Document published on or after the declared
priority date but before the filing date of the
present application.

E: Patent document published on or after, but with
priority date earlier than, the filing date of the
present application.

&: Member of the same patent family,
corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US
patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases
considered for search are also listed periodically in the Official Journal (Patents).